

REMARKS

In the Office Action of July 24, 2008, claims 43 and 47 were rejected under 35 U.S.C. 112, second paragraph because of insufficient antecedent basis. In this regard, claims 43 and 47 have been amended to obviate the rejections.

On page 3 of the Action, claims 1-8, 11, 13-14, 39-40, 43, and 47 were rejected under 35 U.S.C. 102(e) as being anticipated by Cropley et al (US 6811905).

Further, on page 5 of the Action, claims 9-10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Croppley et al. (US 6811905).

On page 6 of the Action, claims 1-11, 13-18, 20-23, 27-28, 32-33, 40, 43, 47 and 52 were rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi et al. (US 5599638) in view of Narayanan et al. (US 6299744).

Claims 9-10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi et al. in view of Narayanan et al. and Narayanan et al. (US 6485851).

Claim 55 was rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi et al. in view of Narayanan et al. and Quang et al. (US 4840783).

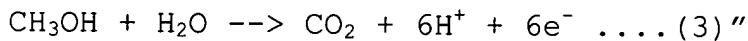
In response to the rejections asserted in the Action, the applicant respectfully traverses on the grounds as follow.

With respect to the anticipation rejections over claims 1-8, 11, 13-14, 39-40, 43, 47, in the present invention, as recited in claim 1, hydrogen-containing gas is generated on the fuel electrode which is an anode. On the other hand, in Cropley, the hydrogen gas is generated on a cathode through the electrolysis.

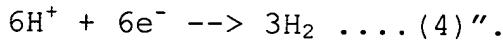
That is to say, the feature of the invention that hydrogen-containing gas is generated on the fuel electrode is disclosed by the present invention for the first time. The present invention has

significant effects which are completely lacking in the electrolysis disclosed in Cropley.

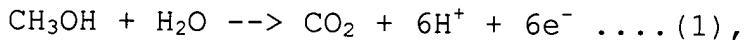
The specification clearly discloses that, in paragraph [0119], "By the way, with regard to a DMFC using a proton conducting solid electrolyte membrane such as Nafion, there has been known a phenomenon called methanol crossover, that is, the crossover of methanol from the fuel electrode to the oxidizing electrode. Thus, it is possible that crossed methanol undergoes electrolytic oxidization represented by the following formula on the oxidizing electrode.



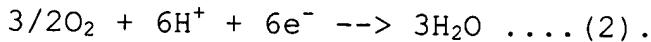
and that, in paragraph [0121], "The  $\text{H}^+$  (proton) produced as a result of the reaction represented by formula (3) migrates through the proton conducting solid electrolyte membrane to reach the fuel electrode to undergo there a reaction represented by the following formula to produce hydrogen,



Namely, in a case of a DMFC, the reaction indicated as (1) below is generated on the fuel electrode (anode).



and the reaction indicated as (2) below is generated on a oxidizing electrode (cathode), thereby generating electricity



In the present invention, as the amount of oxygen supply decreases, the reactions indicated (3), (4) start, thereby generating the hydrogen gas at the fuel electrode (anode).

On the other hand, in Cropley, as is clear from the specification, column 15, lines 24-35, the reaction indicated as  $\text{CH}_3\text{OH} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + 6\text{H}^+ + 6\text{e}^-$  occurs at the anode, and the reaction  $6\text{H}^+ + 6\text{e}^- \rightarrow 3\text{H}_2$  occurs at the cathode. Accordingly, compared to the present invention, the hydrogen gas is generated at the opposite electrode. Furthermore, the electrolysis disclosed in Cropley requires electrical energy.

As opposed to Cropley, the present invention does not require the electrical energy in order to generate the hydrogen gas. If the electrical energy is applied, the normal electrolysis occurs while the hydrogen gas is generated at the fuel electrode (the anode) via the reactions indicated (3) and (4) above.

Therefore, as the specification clearly states in paragraph [0254] "What is important here is that hydrogen was withdrawn from the hydrogen generating cells of Example 3 whose energy content exceeded the electric current supplied from outside. In other words, the hydrogen generating cell of Example 3 generates more hydrogen than is explained by the consumption of supplied electric energy. In addition, conversion of fuel into hydrogen occurred at a surprisingly low temperature of 30 to 90°C. In view of these facts, the hydrogen generating method of the invention and hydrogen generating system based on the method are likely to be novel ones that have never been observed before.", the present invention enables to generate more energy of the hydrogen gas than the electrical energy applied thereto. Accordingly, the present invention has a significant effect and is entirely different from the electrolysis that is disclosed in Cropley.

For the reasons stated above, claims 1-8 should stand allowable over the cited reference.

Also, as for claims 11, 13-14, subject matter of those claims is a hydrogen generating system which employs the same method recited in claims 1, 3-4, respectively. Therefore, claims 11, 13-14 should also stand allowable over the cited reference.

As to the rejections over claims 39-40, 43, 47, since claims 39, 43 and 47 depend from claim 11, and claim 40 depends from claim 39, those claims should stand allowable over the cited reference as well.

As for the obviousness rejections over claims 9, 10, for the same grounds stated above, the present invention would not be obvious from Cropley where the hydrogen gas is generated at the cathode. Therefore, Cropley cannot be a reference to make out a *prima facie* obviousness, and claims 9 and 10 should stand allowable over the cited reference.

As for the rejection over claim 11, the Examiner has taken a position that Surampudi would be equivalent to claim 11 except for a means for removing hydrogen-containing gas from the fuel electrode, and that it would be obvious to modify Surampudi in view of Narayanan. However, in Narayanan as well as Surampudi, the hydrogen gas is generated at the cathode. Therefore, even if Narayanan and Surampudi are combined, it would be impossible to obtain the idea of the present invention about generating the hydrogen gas at the fuel electrode (anode). Accordingly, the cited references, even if combined, cannot make out the *prima facie* obviousness.

As to the obviousness rejections over claim 13-17, and 19, in every reference cited in the Action, the hydrogen gas is generated at the cathode. While the present invention employs 400 mV of

voltage which is the same as that of Narayanan, as stated above, the hydrogen gas is generated at the fuel electrode (anode) thereby generating more energy of hydrogen than the electrical energy applied thereto. Namely, the present invention enables to generate more hydrogen gas than Narayanan. This result is clearly supported by the Example 3 in the specification of the present invention.

Therefore, the cited references cannot make out the *prima facie* obviousness, and claims 13-17, 19, for the same reasons stated above, should stand allowable over the cited references.

As for the rejections over claims 20-23, 27-28, 32-33, 40, 43, 47, and 52, in both of Narayanan and Surampudi, there is a premise that the hydrogen gas is generated at the cathode. Accordingly, the present invention would not be obvious from the cited references, and claims 20-23, 27-28, 32-33, 40, 43, 47, and 52 should stand allowable over the cited references.

Regarding obviousness rejections over claims 1-8, for the same reason stated above, the cited references cannot make out the *prima facie* obviousness.

As to the obviousness rejections over claims 9 and 10, the both references of Surampudi and Narayanan do not disclose that the hydrogen gas is generated at the fuel electrode (anode). Therefore, on the same grounds stated above, the cited references cannot make out the *prima facie* obviousness.

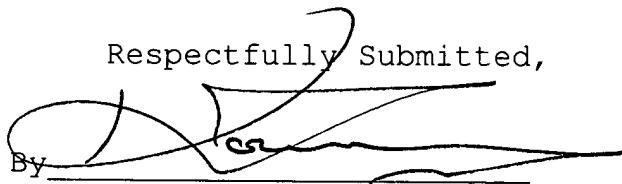
Regarding claim 55, Quang does not disclose that the hydrogen gas is generated at the fuel electrode (anode). Therefore, on the same grounds stated above, the cited references, even if combined, cannot make out the *prima facie* obviousness.

As to the provisional non-statutory double patenting rejection of claims 11-23, 27-28, 43, 47, and 55 as being unpatentable over claims 1-39 of copending Application No. 11/794,357, this rejection is provisionally traversed in that it is not until one of the two application is allowed that one set of claims becomes fixed and a determination as to the need for a terminal disclaimer can be accurately made. It is submitted that a terminal disclaimer will be submitted for the copending Application No. 11/794,357 if necessary.

The specification has been amended to correct clerical errors.

The Examiner's attention is called to the fact that the corresponding Japanese Patent Application No.2004-367792 has issued as Patent No. 3812581.

Reconsideration and allowance are earnestly solicited.

Respectfully Submitted,  
  
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